(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
2 May 2002 (02.05.2002)

PCT

(10) International Publication Number
WO 02/35046 A2

(51) International Patent Classification[7]: E06B 9/00

(21) International Application Number: PCT/DK01/00706

(22) International Filing Date: 25 October 2001 (25.10.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PA 2000 01617 27 October 2000 (27.10.2000) DK

(71) Applicants and
(72) Inventors: **EGHOLM, Kim** [DK/DK]; Kirkeåsen 21, DK-2850 Nærum (DK). **WILLEHADER, Hans** [SE/SE]; Bokhållare Gatan 35d, 2., S-211 56 Malmö (SE).

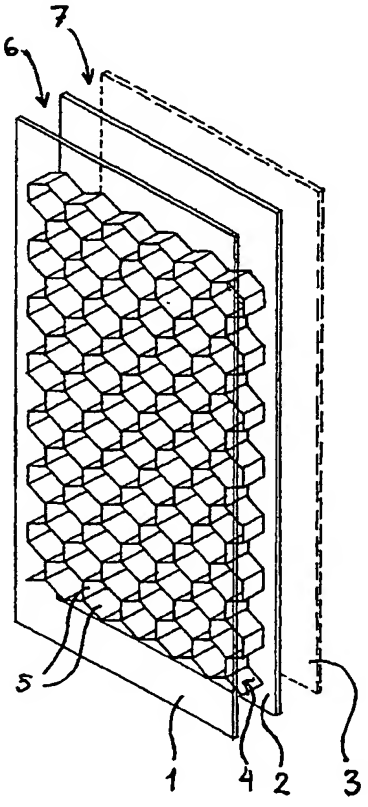
(74) Agent: **PATENTGRUPPEN APS**; Arosgården, Aaboulevarden 31, DK-8000 Aarhus C (DK).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EC, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: AN OPTICAL SCREEN ELEMENT



(57) Abstract: The present invention relates to an optical screen element, such as a partition wall section, a glass facade, a window or the like, comprising a first glass plate and a second glass plate enclosing light manipulating means thereinbetween, wherein the light manipulating means includes a panel having a cell structure that substantially fills the space between said two glass plates and wherein the cell structure is made up by tube pieces in a polymeric material that are compactly accumulated to form a cellular panel. By a screen according to the invention, daylight is polarised, while allowing view through the cell structure parallel to its orientation. The cell structure of a screen element according to the invention allows for unhindered visual access through the screen in one direction of viewing whereas visual access is blocked from other directions. By the optical effect of the screen element of the invention, a new design possibility is offered not only to engineers and building designers but also interior decorators, since it is realised that the screen element can be used for several purposes besides glass panels and facades such as a partition wall, a dividing screen within an office space or the like. Moreover, the polymer material cellular structure makes the cellular panel easy and inexpensive to manufacture.

WO 02/35046 A2

Published:
— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

AN OPTICAL SCREEN ELEMENT

The present invention relates to an optical screen element, such as a partition wall section, a glass facade, a window or the like, comprising a first glass plate and a second glass plate enclosing light manipulating means thereinbetween.

A screen element of this kind is known from e.g. EP-A-0 899 411. In the art, a double-glazed window having a venetian blind enclosed between the glass panels is well-known. Such windows satisfy many light control requirements, but are complex in their construction as the light manipulating means in the form of a venetian blind requires mechanical and - in some designs – even electrical components present in the window structure in order to operate the blind.

Such blinds are often more or less permanently positioned so as to prevent direct sun-light from entering into a building. In an office building or the like during daytime, artificial illumination is used instead of daylight illumination in order to control the level of illumination. Apart from the increase in the use of electricity, which is unpreferable from both a financial and an environmental point of view, the impression of such interior building space can be a somewhat closed working environment, in particular if a large space is further sub-divided by partition walls or screens.

In DE 36 12 681 A1 a security glass screen element with a honeycomb reinforcement panel between two glass sheets is described. This screen element allows direct sunlight to penetrate to some extent. In the disclosure it is stated that the honeycomb panel may be designed in different manners and in different kinds of material, but preferably in a light-weight metal, such as aluminium. However, the manufacture of such panel is difficult and expensive amongst other things because the panels must be handled great care so they are not dented or in other ways damaged. Moreover, in order to provide a real reinforcement, the walls in the honeycomb panel must have a certain thickness, which in turn compromises the transparency of the glass element and thus lowers the visibility into and the illumination of the room behind the screen.

From an architectural point of view, this effect is undesirable in some building designs and it is therefore the object of the present invention to provide an optical screen which is simple in design, manufacture and in use and which allows for direct sunlight to penetrate without lowering the level of illumination unduly and also allows for direct visual access through the screen element in order to achieve a feeling of openness for the persons in a room behind this screen.

This object has been achieved by an optical screen element of the initially mentioned kind, wherein the light manipulating means includes a panel with a cell structure that substantially fills the space between said two glass plates and wherein the cell structure is made up by tube pieces in a polymeric material that are compactly accumulated to form a cellular panel.

By a screen according to the invention, daylight is not shielded but merely manipulated when passing through the screen element. The light may be reflected by the walls of the cell structure and a diffuse light with a relatively high level of illumination is created on the inside of the screen. If the light from the light source is parallel or substantially parallel to the wall of the tubular pieces in the cell structure, the light will become a direct illumination in the room whereby a light architectonic effect is achieved in the room. This effect is enhanced by using thin-walled polymer tubular pieces since the wall thickness may be particular thin, just as this choice of material makes the panel easy to manufacture and the optical screen element light-weight and gives an airy experience for the persons on each side of the partition wall. Preferably, the panel is loosely positioned in the gap between the glass plates. Alternatively, the panel is a permanently fixed cell structure. The cellular structure panel is made of a polymer material whereby a temperature constant cell structure is achieved.

Due to the optical effect which is achieved, a screen element according to the invention will appear as a semi-transparent partitioning wall. The cell structure of a screen element according to the invention allows for unhindered visual access

through the screen in one direction of viewing whereas visual access is blocked from other directions. By the optical effect of the screen element of the invention, a new design possibility is offered not only to engineers and building designers but also interior decorators, since it is realised that the screen element can be used for several purposes besides glass panels and facades such as a partition wall, a dividing screen within an office space or the like. The panel is a fixed cell structure permanently enclosed in the space between two glass plates.

The tubular pieces are provided with a length which substantially corresponds to the distance or gap between the glass plates. Hereby, a uniform optical effect is achieved throughout the whole area of the screen element, since the tubular pieces are hindered in axial movement.

In the preferred embodiment of the invention, the cell structure is made of tube pieces that are compactly accumulated to form a cellular panel. Hereby, a panel sheet is obtainable that is easy and relatively inexpensive to manufacture. Depending on the choice of material for the cell panel, of course, a tubular cell structure provides a superior bending resistance.

In an alternative embodiment of the invention, the cell structure is in a honeycomb pattern. Hereby, a rigid structure of the screen is obtained that is resistant to bending and other impacts, just as a honeycomb cell structure consisting of stacked hexagonal openings is a particularly strong structure compared to its weight while also being particularly open to light penetration.

In a particular simple embodiment of the invention, the cell structure is made of cylindrical tube pieces that are naturally stacked to form the cellular panel structure. Hereby, the tubular pieces may be placed between two glass plates - with the correct orientation of the tubular pieces - and will naturally stack compactly and uniformly due to the cylindrical shape.

The panel is made of tubular pieces of polycarbonate, polypropylene or polyvinylester. Another polymer material could be polyvinyl chloride (PVC). Hereby, a panel is light weight, tough, robust and resilient material, making the cell panel easier to handle during transport and during production of the screen element. By using a polymeric material, i.e. a thermoplastic material, improved heat insulation is obtainable e.g. compared with the aluminium structure. In a preferred embodiment, the cell panel is made of tubular cells of polycarbonate. Hereby, a high impact strength allowing for very thin cell walls. Such tough thermoplastic material has a high softening temperature allowing for a particularly wide temperature variation. However, it is realised that other polymer materials may be used depending on the specific requirements of the screen element, e.g. UV resistance, colouring properties, etc.

In a preferred embodiment, the screen is a heat insulating double-glazed window panel. By this embodiment, the screen element is suitable for use in a glass facade. The facade could either be made entirely of such translucent screen elements or with such elements incorporated in sections of the facade. Moreover, a third glass plate could be provided, said third glass plate constituting the outer plate of the screen element. Hereby, a triple-layer glass heat insulation window panel is obtained on the basis of the invention. The cell structure is preferably situated inside the innermost of the two interior empty volumes in the triple-layer glass window, since the temperature is more stabile in this space. Furthermore, by a double or triple-layer glass screen element, a sound dampening effect may be achieved.

In one preferred embodiment of the invention, the walls of the cell structure are orthogonal to the glass plates. The screen is transparent to the viewer when the line of sight is parallel with the walls of the cell structure. When the walls are orthogonal to the glass surface, the viewer can only experience the transparency when he or she is looking in this particular direction. Moreover, daylight will be reflected in the walls of the cell structure so that the light will be distributed in a particular pattern inside the building with this orthogonal cell structure. In an alternative embodiment, at least a portion of the walls of the cell structure is in an inclined angular position

relative to the glass plates. This will create a different effect for the viewer and a different light distribution in the building.

Moreover, a wall panel comprising a combination of different inclinations of the cell walls, including the orthogonal orientation, could create a particularly attractive light distribution effect.

In an embodiment, the panel is provided with a surface treatment, such as colouring, a mat or glossy coating or the like in order to manipulate the incoming light reflected in the panel. Hereby, incoming light can be manipulated not only in its deflection but also in brightness and colour.

In another embodiment, the inner surface of the third glass plate in a triple-layer glass heat insulating window is provided with a soft coating. This soft coating usually comprises a layer of metal ions provided in order to reflect some components of incoming light, such as UV or heat radiation, and thereby keep these components from penetrating the window.

The cellular panel may be made of the tubular pieces are provided in a transparent or coloured polymer material, which are bonded together by a heat treatment or glue to form the panel prior to the insertion of the panel between the glass plates. The tubular polymer pieces may easily be welded together to form a cellular panel. Alternatively, the cellular panel is made of the tubular pieces, which completely fills the gap and which are loosely filled into the gap between the two glass plates.

The invention will be described in detail below with reference to the accompanying drawings, in which

Fig. 1 is an isometric schematic view of a screen element according to a first preferred embodiment the invention,

fig. 2 is the same in a cross section side view,

fig. 3 is an exploded axonometric view of a screen element according to a second preferred embodiment, and

fig. 4 is a sectional view thereof.

In figures 1 and 2, the screen element includes a first glass plate 1 and a second glass plate 2. Moreover, a third glass plate 3 can be provided as indicated by the broken lines. Between the first and second glass plates 1 and 2, a panel 4 having a cell structure is enclosed in the interior space 6. The screen element may be provided with a frame (not shown) circumscribing the glass plates 1, 2 and possibly 3.

The cell structure of the panel 4 preferably consists of a honeycomb structure, i.e. hexagonal openings in a stacked configuration. This cell structure is a very open and relatively light structure.

The cell structure of the panel 4 may be provided with orthogonal cell walls 5 relative to the glass plates 1 and 2. Alternatively, the cell walls 5 could be inclined so as to direct light reflections in a particular direction and/or shielding transparency from a particular direction relative to the screen element.

When three-layer glass is used as a screen element, such as a three-layer glass heat insulating window, the panel 4 is preferably arranged in the innermost of the two interior volumes 6 and 7 of the screen element. In the innermost space, the temperature is more stabile, whereby the panel is less likely to be deformed due to thermal expansions and contractions due to temperature changes.

If thermal expansion is a problem, the panel 4 may be fitted in the interior space 6 between the two glass plates 1 and 2 in such a way that thermal expansion may be allowed for. The panel 4 could be slightly smaller in thickness than the corresponding dimension of the interior space 6.

The cells could have other shapes than the hexagonal shape, as long as the screen element appears almost fully transparent when viewed in the "transparency direction"

and in particular when viewed from a distance. The transparency level can also be manipulated by a cell structure of a relative large depth or thickness. The thickness can be varied from e.g. 4 mm to about 24 mm or larger e.g. up to 300 to 800 mm. By a relatively large thickness, an even softer light will penetrate through the screen element since the light is reflected between the walls in the cell structure during penetration. Moreover, by using a cell structure with a relative large depth, the angular tolerance in the transparent viewing direction will be narrowed significantly.

In figures 3 and 4, a second embodiment of the invention is shown. In this preferred embodiment, the cell structure 4 is made up by tubular pieces 8 that are stacked and bonded together to form a cellular panel 4 placed between two glass panels 1, 2. This cell panel 4 is particularly advantageous since it is light, easy to produce and to cut into a particular shape. It is also less fragile and much cheaper to produce than a hexagonal aluminium cell structure. In a particularly advantageous embodiment, the tubular cell structure is made of polycarbonate or another suitable polymeric material. The polymeric material may be chosen in accordance with the requirements of the cell structure, such as material requirements regarding UV sensitivity, colouring properties, specific temperature requirements, etc.

The term glass plate is understood to involve any transparent sheet that is suitable for the purpose of the screen element.

This and other modifications of a screen element according to the invention may be made without departing from the scope of the invention, which is defined in the accompanying claims.

The present invention relates to an optical screen element, such as a partition wall section, a glass facade, a window or the like, comprising a first glass plate and a second glass plate enclosing light manipulating means therein between, wherein the light manipulating means includes a panel having a cell structure that substantially fills the space between said two glass plates and wherein the cell structure is made up by tube pieces in a polymeric material that are compactly accumulated to form a

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
2 May 2002 (02.05.2002)

PCT

(10) International Publication Number
WO 02/35046 A3

(51) International Patent Classification[7]: E06B 3/66

(21) International Application Number: PCT/DK01/00706

(22) International Filing Date: 25 October 2001 (25.10.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PA 2000 01617 27 October 2000 (27.10.2000) DK

(71) Applicants and
(72) Inventors: **EGHOLM, Kim** [DK/DK]; Kirkeåsen 21, DK-2850 Nærum (DK). **WILLEHADER, Hans** [SE/SE]; Bokhållare Gatan 35d, 2., S-211 56 Malmö (SE).

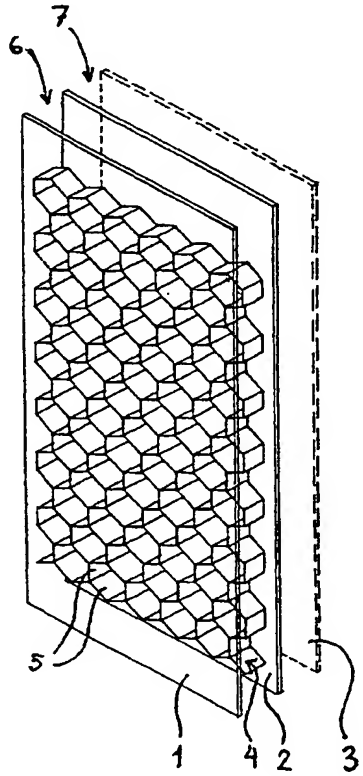
(74) Agent: **PATENTGRUPPEN APS**; Arosgården, Aaboulevarden 31, DK-8000 Aarhus C (DK).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EC, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: AN OPTICAL SCREEN ELEMENT



(57) Abstract: The present invention relates to an optical screen element, such as a partition wall section, a glass facade, a window or the like, comprising a first glass plate and a second glass plate enclosing light manipulating means thereinbetween, wherein the light manipulating means includes a panel having a cell structure that substantially fills the space between said two glass plates and wherein the cell structure is made up by tube pieces in a polymeric material that are compactly accumulated to form a cellular panel. By a screen according to the invention, daylight is polarised, while allowing view through the cell structure parallel to its orientation. The cell structure of a screen element according to the invention allows for unhindered visual access through the screen in one direction of viewing whereas visual access is blocked from other directions. By the optical effect of the screen element of the invention, a new design possibility is offered not only to engineers and building designers but also interior decorators, since it is realised that the screen element can be used for several purposes besides glass panels and facades such as a partition wall, a dividing screen within an office space or the like. Moreover, the polymer material cellular structure makes the cellular panel easy and inexpensive to manufacture.

WO 02/35046 A3

Published:
— *with international search report*

(88) Date of publication of the international search report:
27 June 2002

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 01/00706

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: E06B 3/66
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: E06B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 933113 A (AFG ETABLISSEMENT VADUZ), 8 August 1963 (08.08.63), the whole document	1-4,7,8
A		5,6,9-12
	--	
A	DE 1797168 A (MEINERS, C.O.), 29 July 1971 (29.07.71)	1-12
	--	
A	DE 3612681 A1 (JOSEF GARTNER & CO), 2 July 1987 (02.07.87)	1-12
	--	
A	DE 4140851 A1 (JOSEF GARTNER & CO.), 24 June 1993 (24.06.93)	1-12
	--	

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 January 2002	28. 02. 2002

Name and mailing address of the International Searching Authority
European Patent Office P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel(+31-70)340-2040. Tx 31 651 epo nl.
Fax(+31-70)340-3016
Facsimile No.

Authorized officer
Åke Olofsson / MRo
Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 01/00706

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0899411 A2 (HUNTER DOUGLAS INDUSTRIES B.V.), 3 March 1999 (03.03.99) -- --------	1-12

S/ 73353

INTERNATIONAL SEARCH REPORT

Information on patent family members

06/11/01

International application No.
PCT/DK 01/00706

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 933113 A	08/08/63	CH 364888 A	15/10/62
DE 1797168 A	29/07/71	NONE	
DE 3612681 A1	02/07/87	NONE	
DE 4140851 A1	24/06/93	NONE	
EP 0899411 A2	03/03/99	AU 727114 B	30/11/00
		AU 8192898 A	11/03/99
		US 6123137 A	26/09/00